



Immediate Dentin Sealing For Indirect Esthetic Restorations: A Systematic Review

**Khaled Alghulikh^{1*}, Reem Mohammed Al Kahtani², Sara Abdullah Al Rasayn³
and Sara Khalid Alawad⁴**

¹*Department of Restorative Dentistry, College of Dentistry, Riyadh Elm University, Riyadh, Saudi Arabia.*

²*Prince Sultan Military Medical City, Riyadh, Saudi Arabia.*

³*King Khalid University, Saudi Arabia.*

⁴*King Saud University, Riyadh, Saudi Arabia.*

Authors' contributions

This work was carried out in collaboration among all authors. Author KA Conceptualized of study and statistics application. Author RMAK managed the Literature Search and review. Author SAAIR Extracting relevant data and review writing. Author SKA managed Review writing and final draft preparation. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i39A32156

Editor(s):

(1) Dr. Giuseppe Murdaca, University of Genoa, Italy.

Reviewers:

(1) Vijay Kumar Bodal, Government Medical College Patiala, India.

(2) Mayank Shah, Awadh Dental College and Hospital, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/71347>

Systematic Review

Received 20 May 2021

Accepted 23 July 2021

Published 30 July 2021

ABSTRACT

Background: The progress in the field of dental adhesion has shown great implications for restorative dentistry. Immediate dentin sealing is a technique that was introduced to improve the bonding of indirect restorations. The improvement of bonding techniques to both enamel and dentin promotes the practice of conservative dental treatment. Hence the purpose of the current study was to search for the best available evidence concerning the clinical outcomes of immediate dentin sealing.

Methodology: An extensive search was performed using different online databases (Pubmed, Scopus, Web of Science, Google Scholar and Cochrane library). These search engines were searched for relevant articles by developing relevant search strategies. Three independent authors reviewed studies, collected data, and assessed risk of bias.

*Corresponding author: E-mail: khaled.alghulikh@riyadh.edu.sa

Results: After reviewing 221 studies, duplicates were removed and inclusion and exclusion criteria were applied. Finally, three clinical studies were accepted in this review.

Conclusions: Previous in vitro studies have shown improved outcomes, although there was no strong evidence in clinical studies to prove superiority of this clinical approach.

Keywords: Adhesive system; Bonding; Dentin; Indirect bonded restorations; Indirect restorations; Inlays; Onlays

1. INTRODUCTION

Adhesion is an important factor to consider in cases of severe tooth destruction. During the treatment, if significant dentin was exposed, it is suggested to seal it with a dentin bonding agent. The advancement of using dental adhesives to form a tight seal between freshly cut dentin and the restoration is crucial to protect the pulp and reduce sensitivity during the time between tooth preparation and bonding of the final restoration [1]. In addition, bonding to dentin has been the most challenging factor for bonding ceramic restorations, which impacts the clinical durability of it [2].

The clinical success of indirect restorations depends primarily on the quality of their adhesion to the tooth structure. Many developments and methods have been introduced in recent years to offer a better bond strength, such as immediate dentin sealing [3], which has shown a lot of advantages, but the evidence supporting its effectiveness is still limited [4]. Contaminated dentin after removal of the provisional restoration is not a proper substrate for bonding, so it can affect the bonding strength of self-adhesive cement because it does not require pre-treatment prior to application. To overcome this problem, immediate dentin sealing [3] was proposed in the early 1990s by using etch-and-rinse adhesive resin cement [5].

The immediate dentin sealing technique is a new and advanced method that enables clinicians to seal dentin immediately after preparation using a dentin bonding agent (DBA) after tooth preparation and before taking the final impression. Application of DBA on newly prepared and exposed dentin provides an ultimate dentin bonding potential, since it provides protection to the pulp from bacteria leakage and dentin contamination with residual temporary cement [6]. The immediate dentin sealing approach will give clinicians a better and enhanced outcome, as it enables the dentin bond to evolve without stress during the provisional stage. In addition, it will allow for pre-

polymerization of the dentin bond, providing a better tensile strength [6]. Evidence-based results also showed that IDS will reduce post-cementation sensitivity, yield fewer gap formations, and assure long-term survival of indirect restorations, thus saving both the dentist and patient time during the cementation stage [1,6]. The disadvantage is that most provisional restorative materials are incompatible with IDS, such as bisacodyl materials that failed to seal preparation appropriately, which resulted in IDS contamination and loss retention in the weeks before cementation [7].

Regarding the clinical steps in the IDS application, the first step is to etch the exposed dentin surface with 37% phosphoric acid for 15 seconds. This is followed by rinsing, removing excess moisture by using suction, applying primer and adhesive and light curing for 20 seconds, and then fabrication and cementation of the provisional restoration. One to two weeks later, the clinician starts the next phase by removing the provisional restoration/cement, cleaning and then etching the enamel-sealed surfaces, and then luting the final restoration with a contemporary system [4,5].

The longevity of the indirect ceramic restorations depends on the proper adhesion protocol [8]. Several factors play a role in debonding the indirect esthetic restorations on IDS. These include chemical bonding of free radicals, the concentration of the free radicals, micromechanical interlocking and interpreting network matrices, depth of penetration, increased polarity of the surface due to contact with water, the film thickness, interaction with luting cement, preparation design, time of placement of the restoration, type of adhesive system, interaction with impression material and provisional restorations, conditioning method, microleakage, and hypersensitivity [9].

The result of significant evidence from in vitro studies and clinical trials is that immediate dentin sealing for indirect restoration has shown significant differences compared to delayed

dentin sealing [2]. More long-term studies need to be conducted in this field [2,7]. Hence the purpose of the current study was to search for the best available evidence concerning the clinical outcomes of immediate dentin sealing.

2. MATERIALS AND METHODS

This systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [10]. The components of the research question (PICOT) in this review are:

Population: Adult patients with permanent teeth who need indirect esthetic restorations

Intervention: immediate dentin sealing

Comparator: delayed dentin sealing

Outcome: improved bond strength and reduced postoperative sensitivity

Timing: One month of follow-up.

This review investigated whether using immediate dentin sealing advanced technique after freshly cut dentin for indirect aesthetic restorations improves the bond strength and reduces postoperative sensitivity. The study was registered and approved by the research center at Riyadh Elm University with the following registration number: (SRS/2020/36/216/212)

A comprehensive search was performed using five online databases. Three of them (PubMed, Cochrane library, and Web of Science) are used by creating search strategies and the other two (ClinicalTrials.gov and the ADA Center for Evidence-Based Dentistry) are used through manual searches.

The search engines were searched for relevant articles based on these inclusion criteria:

- Clinical trials
- Observational studies
- Permanent teeth only
- One month of follow-up
- Papers published after 01/01/2000
- Full-text articles available
- Papers in English

The exclusion criteria were:

- Review studies
- In vitro studies

- Studies on primary teeth
- Less than one month of follow-up
- Full article is not published or not in the English language.

Three readers were standardized to evaluate the studies for risk of bias, and then strength of recommendation. The process of evaluation was completed using the revised risk of bias instrument [11] and the Ex-GRADE [12]. The calibration process for the three readers was performed on a pilot clinical trial.

3. RESULTS

The initial search identified 221 studies attained from five different databases. After removal of duplicate studies and application of the inclusion/exclusion criteria, 161 studies were screened, and the final number of studies that matched the PICOT question were 3, as shown in Graph (1).

3.1 Assessment of Clinical studies

The included studies were evaluated using the Ex-GRADE instrument, which has two main arms: quality of the evidence and strength of recommendation. The revised risk of bias instrument was used to evaluate the quality of the evidence by assessing design/quality, consistency, directness and precision. The second arm of Ex-GRADE has seven questions to evaluate the strength of recommendation.

The following clinical trials were accepted:

1. Performance of ceramic laminate veneers with immediate dentine sealing: 11 year prospective clinical trial[13].
2. Prospective Randomized Clinical Trial on the Survival of Lithium Disilicate Posterior Partial Crowns Bonded Using Immediate or Delayed Dentin Sealing: Short-term Results on Tooth Sensitivity and Patient Satisfaction[14].
3. Randomized clinical trial on the survival of lithium disilicate posterior partial restorations bonded using immediate or delayed dentin sealing after 3 years of function[15].

The assessment of these studies for quality of the evidence and strength of recommendation did not reveal any bias and showed strong quality of evidence.

4. DISCUSSION

Qualitative analysis was performed for the included clinical trials. Data extraction was performed to combine results from the included studies and are summarized in Table (1) for further assessment. Here interpretation of the results primarily focused on intervention and measuring the outcomes. (Table 2)

i. Performance of ceramic laminate veneers with immediate dentine sealing: 11 year prospective clinical trial [13]

A total of 118 patients were involved in this prospective clinical study. These patients received 444 indirect ceramic laminate veneers had teeth with more than 50% dentin exposure that were sealed with immediate dentin sealing. Two calibrated dentists evaluated these restorations during the follow-up visits (baseline, three months, one year and final follow-up). Clinical evaluation included mirror and probe inspection, light transillumination and the patient's response questionnaire. In the first four years of this study, IDS was not used. Once IDS was used for teeth with 50% of

dentin exposed, it showed improved clinical outcomes and significantly less failure.

ii. Prospective Randomized Clinical Trial on the Survival of Lithium Disilicate Posterior Partial Crowns Bonded Using Immediate or Delayed Dentin Sealing: Short-term Results on Tooth Sensitivity and Patient Satisfaction [14]

In this prospective randomized clinical trial, 30 patients received indirect ceramic restorations on two molars each (60 in total). The teeth received IDS or DDS, and the aim of the study was to evaluate postoperative sensitivity and the patient's satisfaction. A coolant spray was used for the assessment of sensitivity, and a visual analog scale was used for the assessment of color. Patients were asked to evaluate their satisfaction regarding color and shape of the restorations and chewing ability. No significant differences were reported in postoperative sensitivity or the patient's satisfaction.

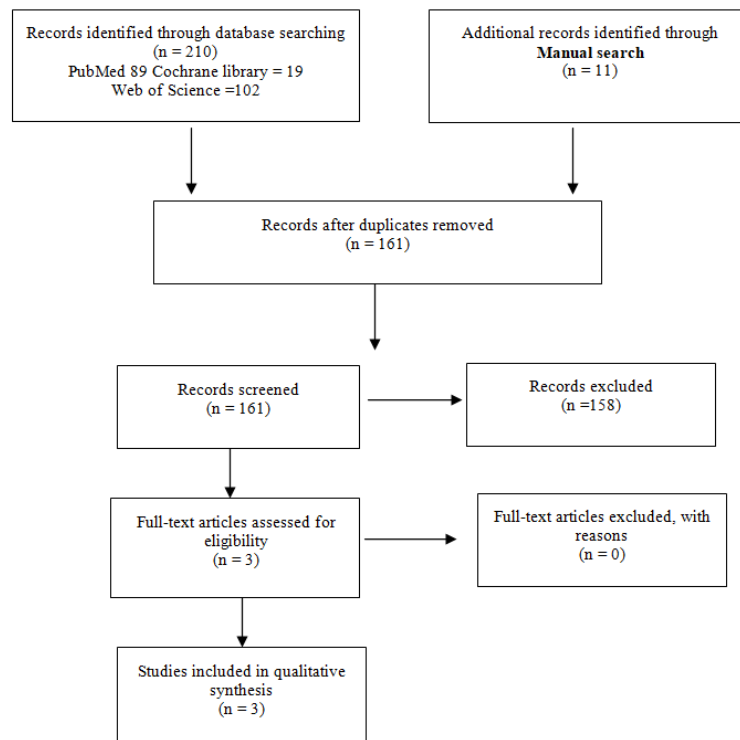


Fig. 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)

Table 1. Average scores for clinical trials evaluation using the Ex-GRADE instrument and the revised risk of bias instrument of three readers

Clinical Trials Assessment				
Clinical trial	R1	R2	R3	Average
Study 1, Gresnigt et al. [13]	30	28	30	29
Study 2, van den Breemer [14]	35	32	34	34
Study 3, van den Breemer [14]	34	36	35	35

Table 2. Interpretation of the results focused on the intervention and measuring the outcomes

Clinical trial	Population	Intervention	Outcomes	Follow-up time
Study 1 Gresnigt et al. [13]	118 patients(mean age: 42.1 years), 44 teeth	44 teeth received indirect ceramic laminate veneers and teeth with more than 50% of dentin exposure were sealed with IDS	Using IDS for teeth with 50% dentin exposed showed improved clinical outcomes and significantly less failure	8 to 133 months
Study 2 van den Breemer [14]	30 patients(mean age, 54 years old), 60 molar teeth	60 teeth received indirect ceramic restorations using IDS or DDS and then postoperative sensitivity and patient's satisfaction were evaluated	Nonsignificant difference reported in postoperative sensitivity or patient's satisfaction.	1 year
Study 3 van den Breemer [15]	30 patients(mean age, 54 years old), 60 pre-molar teeth	60 teeth received partial coverage ceramic restorations.	Nonsignificant differences in the success and survival rates and the quality of survival when IDS or DDS were used.	36 months

iii. Randomized clinical trial on the survival of lithium disilicate posterior partial restorations bonded using immediate or delayed dentin sealing after 3 years of function [15]

Thirty patients were recruited for this randomized clinical trial to receive two partial coverage ceramic restorations. These restorations were evaluated at follow-up visits for up to 36 months. FDI criteria were used for the evaluation of these restorations. The results showed non-significant differences in the success and survival rates and the quality of survival when comparing the use of IDS and DDS.

Because of the limitations of the included studies, a strong clinical recommendation cannot be made, but the qualitative assessment supports the positive clinical outcomes of IDS. These improved clinical results have been associated with using filled DBA [16]. In contrast, a recent in vitro study has shown superior marginal adaptation of ceramic inlays when using IDS [16]. Clinicians have reported that there is a disadvantage of this technique due to the interaction between impression materials and the layer of resin. The interaction results in formation of an oxygen inhibition layer. Prophylactic paste and Marseille soap have been proven to prevent any negative interaction between the impression material and the bonded dentin [8]. Coating IDS with flowable resin composite is recommended to preserve the bonded layer and prohibit interaction with the impression material [16].

5. CONCLUSION

The inconsistency of the study designs and the outcomes of measurements did not allow performing a meta-analysis and statistical interpretation. One study showed improved clinical outcomes when IDS was applied. Although the evidence reported from in vitro studies showed better clinical outcomes, there was no strong evidence in clinical studies to demonstrate superiority of this clinical approach.

6. RESEARCH RECOMMENDATIONS

In terms of a systematic review, the current review has the limitation of including only a small

number of studies. More clinical trials and observational clinical studies are needed for the assessment of immediate dentin sealing in clinical practice. There is a need to investigate whether the use of immediate dentin sealing can reduce sensitivity and improve the bonding of indirect esthetic restorations.

7. CLINICAL RECOMMENDATIONS

Data in the literature support the use of immediate dentin sealing. Although clinical studies in the field are limited, it is suggested to implement immediate dentin sealing when exposed dentin is encountered after preparing the tooth for indirect esthetic restoration.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

ACKNOWLEDGEMENT

The authors would like to thank the management for supporting us to carry out this systematic review

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCE

1. Nawareg MM, et al. Adhesive sealing of dentin surfaces in vitro: A review. *Am J Dent*, 2015; 28(6):321-32.
2. Van den Breemer CRG, et al. Prospective clinical evaluation of 765 partial glass-ceramic posterior restorations luted using photo-polymerized resin composite in conjunction with immediate dentin sealing. *Clin Oral Investig*, 2021; 25(3):1463-1473.
3. Dietschi D, et al., In vitro evaluation of marginal and internal adaptation after occlusal stressing of indirect class II composite restorations with different resinous bases. *European journal of oral sciences*, 2003; 111(1):73-80.
4. Magne P. Immediate dentin sealing: a fundamental procedure for indirect bonded

- restorations. *J Esthet Restor Dent*, 2005;17(3):144-54; discussion 155.
5. Shafiei F, Aghaei T, Jowkar Z. Effect of proanthocyanidin mediated immediate and delayed dentin sealing on the strength of premolars restored with composite resin inlay. *J Clin Exp Dent*, 2020;12(3):e235-e241.
 6. Magne P, WS. So, D. Cascione, Immediate dentin sealing supports delayed restoration placement. *J Prosthet Dent*, 2007;98(3):166-74.
 7. Qanungo A, et al. Immediate dentin sealing for indirect bonded restorations. *J Prosthodont Res*, 2016;60(4):240-249.
 8. Sinjari B, et al. Avoidance of Interaction between Impression Materials and Tooth Surface Treated for Immediate Dentin Sealing: An In Vitro Study. *Materials (Basel)*, 2019;12(20).
 9. Samartzi TK, Papalexopoulos D, Sarafianou A, Kourtis S. Immediate Dentin Sealing: A Literature Review. *Clin Cosmet Investig Dent*. 2021;13:233-256.
 10. Moher D, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*, 2009;6(7):e1000097.
 11. Barkhordarian A, et al. Assessment of risk of bias in translational science. *J Transl Med*, 2013; 11:184.
 12. Phi L, et al. Expanding the Grading of Recommendations Assessment, Development, and Evaluation (Ex-GRADE) for Evidence-Based Clinical Recommendations: Validation Study. *Open Dent J*, 2012;6:31-40.
 13. Gresnigt MMM, et al. Performance of ceramic laminate veneers with immediate dentine sealing: An 11 year prospective clinical trial. *Dent Mater*, 2019;35(7):1042-1052.
 14. van den Breemer C, et al. Prospective Randomized Clinical Trial on the Survival of Lithium Disilicate Posterior Partial Crowns Bonded Using Immediate or Delayed Dentin Sealing: Short-term Results on Tooth Sensitivity and Patient Satisfaction. *Oper Dent*, 2019;44(5):E212-e222.
 15. van den Breemer CRG, et al. Randomized clinical trial on the survival of lithium disilicate posterior partial restorations bonded using immediate or delayed dentin sealing after 3 years of function. *J Dent*. 2019;85:1-10.
 16. de Carvalho MA, et al. Significance of immediate dentin sealing and flowable resin coating reinforcement for unfilled/lightly filled adhesive systems. *J Esthet Restor Dent*, 2021;33(1):88-98.

© 2021 Alghulikah et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/71347>